Space Weather Technical Forecast

Issued on Friday, 28 June 2024 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-class flares throughout. Chance of Active to G1 Minor Storm intervals days 1-2 (28-29 Jun).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with occasional low level C-class flares. The peak flare was a C6.6. There are now eleven regions on the disc, with the previously elongated and complex AR3723 now reanalysed as two separate regions and subsequently re-classified, with the new AR3730 constituting the previous leading portion of that group. AR3729 is now the most complex single region, located close to the east limb, but rotating into clearer view. All sunspots on the disc showing only very slow evolution over recent hours.

We await modeling output for a CME observed in coronagraph imagery leaving the Sun to the southwest, likely associated with a small flare from the AR3719 region approximately 27/1710UTC. Otherwise no likely Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds observed by ACE/DSCOVR at L1, were background, between 320-350 km/s on a flat trend. Density was average to just above average throughout. The Interplanetary Magnetic Field, Bt, was initially weak, but became persistently moderate from 27/0713 UTC, increasing to 13nT at peak around 27/1100 UTC. Bz, varied weakly to start the period, but generally rotated to a moderately positive (northward) direction from 27/0630 UTC, peaking around +10nT, before trending negative (southward) from approximately 27/1100UTC to become weakly negative. Phi angle was positive (towards the Sun). Geomagnetic activity was generally Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background with no solar radiation storms occurring. High energy electron flux (greater than 2MeV) observed by GOES16 was at background. The 24-hour fluence remained below Active, with 1.08e6 integrated pfu observed at 28/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity expected with a chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: Three CMEs feature in the forecast period. The first from 23 Jun may be providing the current weak enhancement. The second from early on 25 Jun may have a glancing impact from later on day 1 (28 Jun). The third CME from late on 25 Jun may arrive late day 2 or early day 3 (29-30 Jun), but any impact is expected to be rather weak and slow. Otherwise, solar winds are expected to remain at generally background levels.

Geomagnetic activity is expected to be Quiet overall with Unsettled intervals, but increasing to Active to G1 Minor storm with any CME arrivals, most likely day 1-2 (28-29 Jun).

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Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background. However, there is a very slight chance of exceeding the S1/Minor Storm threshold should any notable flares occur from the numerous sunspots that currently occupy the visible disc. High energy electron flux is forecast to be at background. The associated 24-hour fluence is expected to remain well below the Active threshold.

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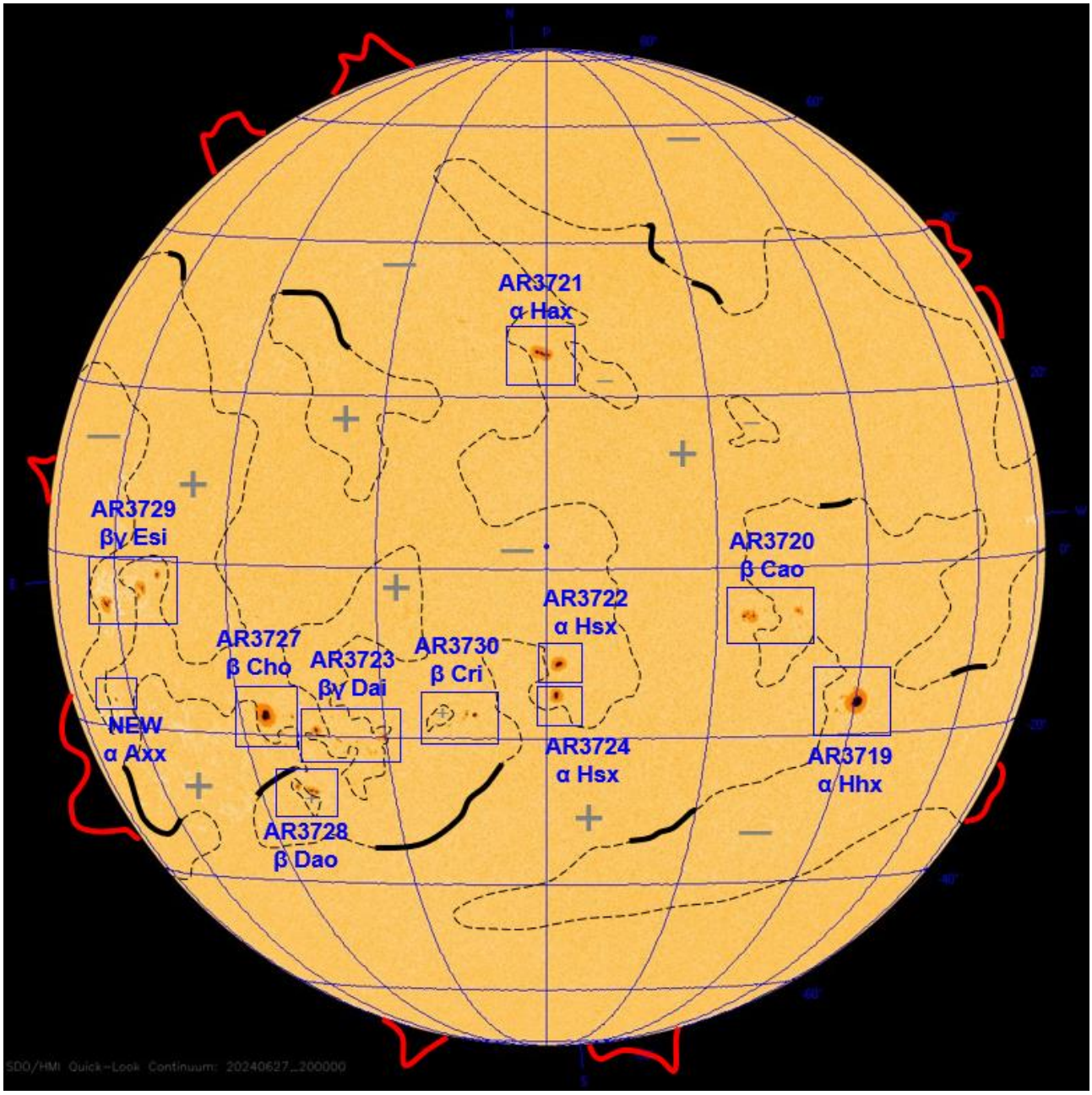
Figure 1. Solar Analysis Valid 27/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are three CMEs currently featuring in the forecast. The first is associated with a filament eruption on 23 Jun and is expected to miss just behind and south of Earth orbit. However, a weak glancing influence is perhaps ongoing giving recent enhancement to the near Earth environment.

The second CME is associated with large filament disruption from the west disc early on 25 Jun, resulting in a broad asymmetric partial halo as seen from STEREO A. This CME has a potential Earth directed component possibly arriving late on day 1 (28 Jun). Although the CME was slow, and only a glancing blow is indicated, filament eruption CMEs can higher densities on arrival, with a chance of giving a period of Active to G1/Minor geomagnetic storms.

The third CME was associated with a C3.9 flare from near AR3720 late on 25 Jun. There was a weak signal in LASCO C2 imagery, with a southward directed partial halo due to the south-centre source location. Glancing arrival is possible late day 2 (29 Jun) or early day 3 (30 Jun), also with the potential for a further period of Active to G1 Minor Storm intervals.

There are no coronal holes on the Earth-sided disc, so aside from any CME arrivals, solar winds are expected to remain at background speeds with mainly Quiet to Unsettled geomagnetic activity.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	40	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
24/0054	Partial	Filament	SE	436 km/s	Ongoing	Glancing Impact
25/1527	Partial	Filament	SW	446 km/s	28/2100 +/- 6hrs	Glancing Impact possible
26/0701	Partial	C3.9 AR3720 + Filament	S-Centre	400 km/s	29/1400 +12/-6hrs	Only weak impact likely

Figure 2: Latest MOSWOC ENLIL Ensemble output, showing multiple glancing CME impacts possible during the period.

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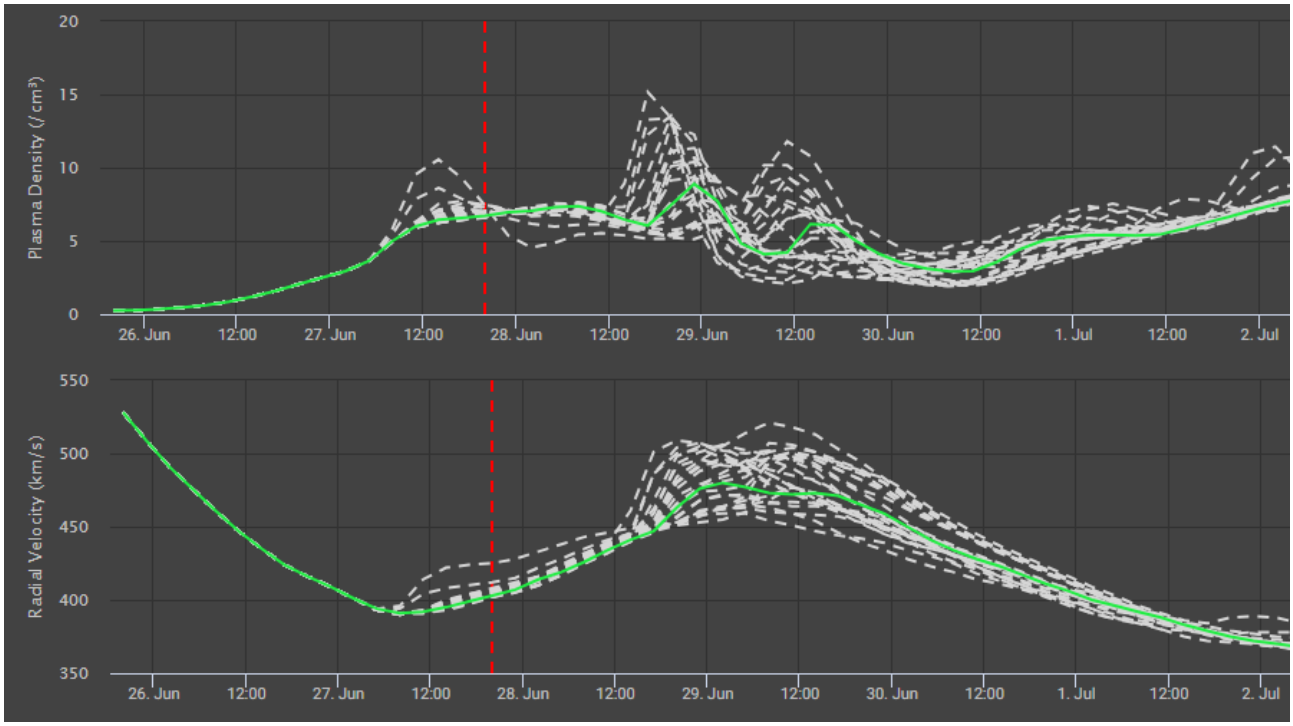

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Radio Blackouts - X-Ray Flares:
There are now eleven regions on the disc, with the previously elongated and complex AR3723 now reanalysed as two separate regions and subsequently re-classified, with the new AR3730 constituting the previous leading portion of the group. This reclassification hasn't significantly downgraded the total assessed flare risk however and this whole region remains a significant watch point given the magnetic complexity visible. AR3729 is also a potential flare source although this region perhaps looking magnetically simpler as it rotates further into view. All sunspots on the disc showing only very slow evolution at this time.

Far side sounding data and persistence suggest the potential for one or more regions to rotate around the eastern limb during the period and all current main flare risk regions remain on the visible disk throughout. Therefore an ongoing daily chance of isolated M-class flares is maintained pending further developments, with a slight chance of isolated X-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

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Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as measured by GOES-18, is expected to remain at background. The numerous sunspots on the Earth-facing are either away from the better connected west limb, or relatively simple and stable, so thought unlikely to produce significant flares that would lead to the observed proton flux at GOES rising.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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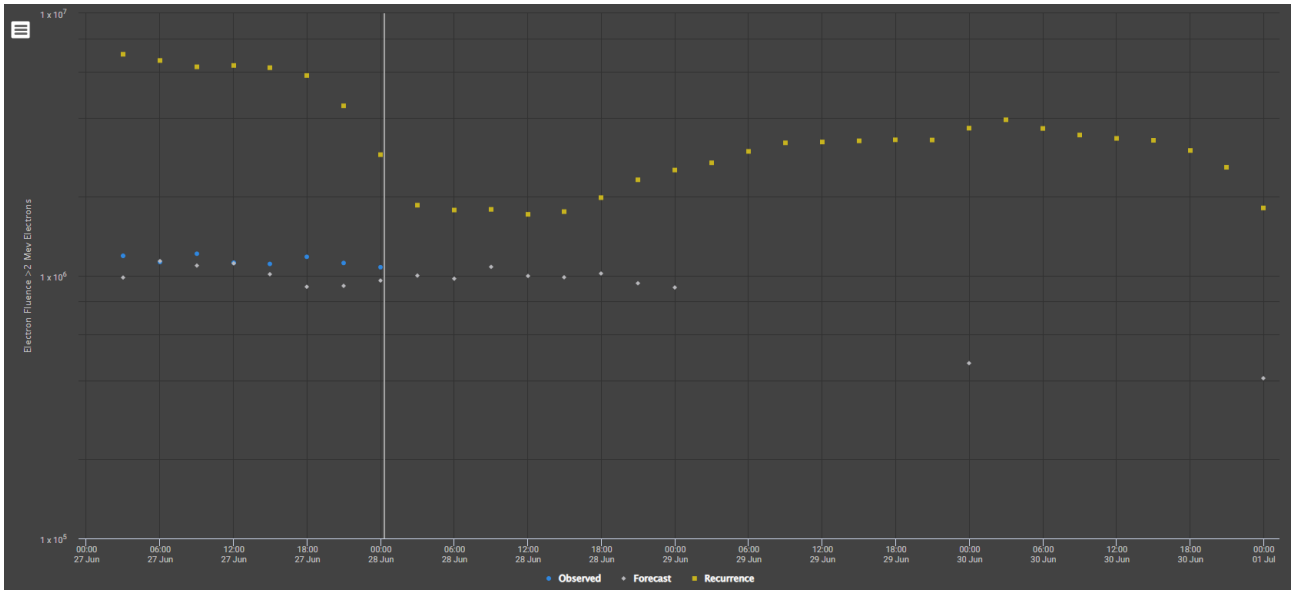
High Energy Electrons Event (≥ 2MeV):
High energy electron flux, as observed by GOES-16, is expected to remain at generally background levels. With no notable sources of enhancement forecast.

Associated electron fluence is expected to persist well below the Active threshold (1e8 integrated pfu), with MOSWOC REFM output considered to be giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output.



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